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Diseases of Cucumbers and Melons in Iowa

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DISEASES OF CUCUMBERS AND MELONS IN IOWA

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The profitable production of cucumbers, cantaloupes and watermelons, collectively known as cucurbits, depends on the selection of varieties, proper soil conditions, fertilizers, and the control of insects and diseases. Growers generally realize the importance of the first three, but neglect the diseases because they do not understand them. Diseases of cucurbits (cucumbers and melons) in Iowa have become so serious that these crops have been discontinued by many growers even where soil and other conditions are very favorable.

The diseases affecting cucumbers and melons are caused in some cases by bacteria, in others by fungi and one is due to a virus. These organisms live in the cucumber and melon plants, and require right conditions for good growth. Cool, damp weather is most favorable for the growth and development of fungi and bacteria. Under such conditions the crop losses incurred are largely due to the increased activities of these organisms.

ANTHRACNOSE ON CUCUMBERS AND CANTALOUPES

Anthracnose, a destructive fungus disease, is very important in Iowa, especially on cantaloupe and watermelon. The disease kills the leaves, which materially reduces the yield. In severe attacks, plants are killed early in the summer and numerous cases were noticed during 1923 and 1924 where plants died before any of the melons were matured. The greatest damage, however, results in shortening the bearing season. In a number of fields in 1924, anthracnose killed the plants shortly after the first picking.

Fig. 1. A cantaloupe plant practically killed by anthracnose. The fruits did not mature. Melons on such plants have a poor flavor and many fail to mature.

SIGNS OF THE DISEASE

The anthracnose organism produces dead areas on the leaves, leafstalks, stems and fruits of attacked plants. The disease causes the leaves to fall and the melons are spotted. On the leaves the older infected areas are angular in outline, while on the stems and leafstalks these areas are narrow and long. Round or oval spots are produced on the fruits. At first the spots are sunken, with a water-soaked appearance. They increase in size and later consist of dark colored dead tissue extending deep into the melons.

On Cantaloupes

Anthracnose lesions on the leaves of cantaloupe, at an early stage after infection, have a narrow, water-soaked or yellowish border. The lesions become angular in outline, consisting of brownish, dry, dead tissue. Stems and leafstalks when attacked, often become girdled, due to the infection. In serious outbreaks of the disease, all the leaves surrounding the center of the hill are killed, due to the leaf infections and the girdling of the leafstalks.

On cantaloupe fruits, infections first assume a sunken, dark green, water-soaked appearance. (Fig. 2.) Following a period of cloudy damp weather, the buff colored spore masses may easily be seen on the fruit lesions. (Fig. 3.) After spore production ceases, these lesions on the fruits appear black. A rotting of the fruit frequently follows infection with anthracnose, especially from lesions on the lower sur-

Fig. 2. Early stage of anthracnose development on cantaloupe.

Fig. 3. Later stage of anthracnose on cantaloupe. The large spots were buff colored, due to masses of spores.

face of the fruit. This rotting may largely be due to other organisms which gain entrance thru the wounds produced by the anthracnose organism.

On Watermelons

Watermelon vines affected with anthracnose present a black or scorched appearance. The leaf lesions are black, rather than reddish-brown, as is the case in cantaloupes. The shedding of leaves at the center of the plants often becomes severe.

On the melons, the lesions are light gray (fig. 4) and here also may be found the masses of pink or buff colored spores. Fruits that are attacked when young often become malformed and if attacked early, may drop off the plant.

On Cucumbers

Leaf symptoms of cucumbers affected with anthracnose closely resemble those of cantaloupes. Leafstalks, stems and fruits are not so seriously attacked as are either cantaloupe or watermelon. Fruit infections first present a water-soaked, sunken appearance and later the buff or pink spore masses become evident as described on affected cantaloupes.

CASUAL AGENT

Anthracnose of melons and cucumbers is caused by a fungus plant which grows and feeds in the leaves, stems, and fruit. Spores are produced on infected plants and are distributed to surrounding ones by splashing rain, air currents, insects, or by other methods. The germinating spores penetrate into the plant and cause new infections. The fungus plant body and the spores are miscroscopic in size, but af-

Fig. 4. Anthracnose on watermelon.

fected areas may become one-half inch or more in diameter. The spores are often produced on the fruits of cantaloupe or watermelon in such quantities that they are easily seen as yellowish-pink masses on the affected areas.

Following infection, the anthracnose fungus spreads within the plant, destroying the tissues, and finally produces more spores which in turn are capable of producing new infections. This cycle may be repeated every 6 to 10 days thruout the growing season, providing weather conditions are favorable.

Effect of Weather Conditions

Weather conditions are important in determining whether spores produce new infections. Moist, humid weather is especially favorable, while dry, hot weather is unfavorable. This explains the severity of anthracnose during the cool, rainy season of 1924.

Overwintering

The fungus causing anthracnose of cucurbits overwinters both in the soil and on the surface of the seeds. The spores are probably lodged on the seeds in pulping the melons in seed extraction. Weather and soil conditions following the planting of the seeds which are favorable for germination of the cucurbit seeds are also favorable for the growth of the fungus spores and infection of the young seedlings results.

CONTROL

Anthracnose of cucumbers and cantaloupes does not exist in land that has never grown these crops. Therefore, the best way to control the anthracnose disease is to avoid introducing it into the soil.

However, where the disease is present, other control measures must be used. These include a long rotation, and spraying and dusting.

The anthracnose organism will live in the soil for several years; thus a long rotation is necessary. Spores of the anthracnose organism on the surface of the seeds can be killed by seed treatment. In order to avoid introducing the disease into a field, all cucumber, watermelon and cantaloupe seed should be treated before plainting. (See seed treatment on page 14.)

When anthracnose has gained a foothold, the most practical way of fighting it is to spray or dust to prevent it spreading on the infected plant or to other healthy plants. Experiments conducted at Avon Lakes, Iowa, during the season of 1924, indicate that even under exceedingly favorable conditions for development of anthracnose, the disease may be successfully combated by the use of bordeaux spray or Sander's bordeaux dust. Bordeaux spray gave slightly better control than did Sander's bordeaux dust. However, due to the ease and rapidity with which a dust may be applied, the use of Sander's bordeaux dust seems preferable. Directions for preparing bordeaux mixture and Sander's bordeaux dust are given on pages 14 and 15.

It is not necessary to begin spraying or dusting for anthracnose until the signs of the disease begin to appear. In the case of bordeaux spray, apply every ten days or two weeks until the crop is harvested. If Sander's bordeaux dust is used, make applications at weekly intervals or oftener if the dust is washed off by rain. A continuous stream duster is more effective than the puff type. Dust after, rather than before, a rain so that the dust may not be washed off.

BACTERIAL WILT OF CUCURBITS

Bacterial wilt is one of the most serious diseases affecting cucumbers and cantaloupes. It is present in all commercial cucumber and cantaloupe growing sections of Iowa and causes severe damage. It also occurs generally in gardens and other small plantings thruout the state.

SIGNS OF THE DISEASE

Bacterial wilt causes wilting and death of the plants, (fig.5) which succumb very rapidly when conditions are most favorable for the disease, and a plant that is apparently normal one day may become wholly wilted the next day. Cucumbers and cantaloupes may be killed at any stage from seedlings to maturity. A plant may at times show numerous leaf infections without general wilting. In 1924, bacterial wilt was very abundant in Iowa and affected plants were frequently found where a large percentage of the older leaves were infected but where the disease had not progressed down the leafstalks into the stem. The rapidity with which a plant is killed depends upon the weather conditions and the disease is serious only in temperate regions.

CAUSAL AGENT

The bacterial wilt organism is very small, rod-shaped and consists of a single cell. Reproduction is rapid, less than one-half hour being required under favorable conditions for a new germ to be formed.

The organisms producing bacterial wilt of cucurbits occur in the water conducting vessels of infected plants. By cutting cross-sections of infected stems or leaf pedicles, a white sticky fluid may frequently be noticed coming from the ends of the cut veins.

Fig. 5. A cucumber plant affected with bacterial wilt.

Distribution and Overwintering

The bacterial wilt organisms depend on wounds for entrance and are carried from plant to plant by cucumber beetles. Both the 12 spotted cucumber beetle and the striped cucumber beetle spread bacterial wilt. Striped cucumber beetles feed readily, or perhaps preferably, on leaves affected with bacterial wilt. Not only are cucumber beetles effective carriers, but they also afford a means for the bacteria to live over from year to year. The wilt bacteria live over winter in the bodies of beetles and in the spring are carried by these beetles to the current season's cucumbers and cantaloupes.

CONTROL

The control of bacterial wilt consists in preventing infection. Plants once infected cannot be cured by applying sprays. For the control of this disease infected plants should be weeded out and cucumber beetles must be controlled.

Pulling up infected plants should help check the wilt disease, particularly where it is confined to only a few plants and where beetles are not present in great numbers. Where the disease is prevalent in a field, or where cucumber beetles are present in large numbers, weeding out infected plants is of doubtful value because diseased plants do not wilt immediately after infection, and because it is difficult to remove all affected plants. The infected plants that are pulled up should be buried so that the beetles cannot feed on them.

To avoid infection by bacterial wilt organisms, the beetle should be controlled by dusting with an insecticide, beginning at the time the seedlings come up. While the plants are small, calcium arsenate and gypsum mixed (one part of the arsenate to 20 parts of gypsum) should be applied. At this stage, the dust may be applied with an old pail punched full of holes in the bottom or it may be applied with the

hands. The plants should be dusted often enough to keep the foliage covered. For small plantations, the plants may be protected by placing a screen frame over them instead of using a dust. As the plants become larger, the insecticide should be applied with a duster and calcium arsenate and hydrated lime should be used instead of the arsenate with gypsum.

THE MOSAIC DISEASE

Mosaic disease attacks a large number of cultivated plants and weeds, including cucumber, cantaloupe, squash, pumpkin, tomato, potato, celery, lettuce, catnip, zinnia, jimson weed, wild ground cherry and spotted spurge. In Iowa, mosaic is found on cucumbers and cantaloupe wherever these crops are grown. It materially reduces the yield, especially of cucumbers.

SIGNS OF THE DISEASE

Leaves. The symptoms of mosaic on infected cucumber and cantaloupe leaves is, in general, a yellow and green mottling. The yellowish and dark green areas are irregular in shape and size. The green areas are slightly raised, giving the leaf a puckered, slightly crinkled appearance. The mottling is most apparent on younger leaves. As the leaves grow older, the mottling often becomes obscured or entirely masked.

In addition to the mottling of the leaves, mosaic frequently produces stunting, especially in cucumbers. Cucumbers attacked when young remain small, seldom developing into vigorous, productive plants. Stunting is most frequent late in the season, after the plants begin bearing. The new growth which has been stunted by mosaic produces an abnormal number of small leaves. The internodes of the stem are greatly shortened and this, together with the large number of leaves produced at the nodes, gives the vine a rosette-like appearance. More flowers, also, are produced than is normally the case, but only a few small, worthless fruits are borne.

Fruits. Fewer fruits, many of which are inferior in quality, are borne on plants affected with mosaic. Many of the cucumbers borne on mosaic vines are distorted, malformed and worthless. Mottling of the fruits in yellowish-green and dark-green areas is especially undesirable in cucumbers to be sold for slicing or pickles. Cantaloupes, tho not as seriously damaged by the mosaic disease as are cucumbers, are reduced in yield.

CAUSAL AGENT

The cause of the mosaic disease is unknown, but it is classed in that group of animal and plant diseases known as virus diseases. Foot and mouth disease, and hog cholera are examples of virus diseases affecting animals. The organisms responsible for the diseases in this class are probably so small that they cannot be seen with our most powerful microscope. Because of this fact, little is known about the nature of the causal agent of mosaic. It is known, however, that this disease is exceedingly infectious. A small drop of plant juice from an infected plant is sufficient to infect healthy plants even if it has been diluted in water 10,000 times.

Transmission of the Disease

The mosaic virus is transmitted by the transfer of juice from an infected plant into healthy susceptible ones, either by man or insects.

The disease may be spread by man in cultural operations or by contact with infected and healthy plants where these are slightly injured.

Certain insects are the most important agents which spread mosaic. Aphids (or plant lice), especially the melon aphid, and cucumber beetles, are the most important spreaders of mosaic among the cucurbits. By feeding on infected plants, these insects are contaminated with the mosaic virus, which is then carried to susceptible healthy plants. Due to the large number of these insects that oftentimes are found in cucumber and cantaloupe fields, the transmission of mosaic from infected to healthy plants is very rapid.

Overwintering of Mosaic

The mosaic virus is probably not carried over from year to year in the soil or in insects. Wild cucumber is known to carry the mosaic disease over winter in the seeds. Transmission of mosaic in the seeds of cucurbits, however, is rare and does not account for much of the initial infections. The mosaic virus is carried by the seeds of several other crops as peas, clover, beans, soybeans and lettuce. It is not borne by seeds in the case of tomatoes, tobacco and peppers.

The virus lives over in the perennial parts of infected plants. Root stalks, tubers and underground stems perpetuate mosaic virus from year to year. Mosaic virus lives over winter on hoarhound, sweet clover, wild ground cherry, milkweed and potato.

Initial Infection of Mosaic to Cucumbers and Cantaloupes

It has been found that mosaic disease can be transmitted between species belonging to different families and orders of plants. Cross-infections have been secured between susceptible cucurbits and tobacco, tomato, petunia, celery, cow peas and spotted spurge. These results indicate that cucurbits may become infected with mosaic from plants belonging to numerous other species. Among such are included species that live more than one year and species that carry the disease over winter in the seed. The fact that certain insects, including the melon aphid and cucumber beetle, feed on various species of plants in addition to cucurbits, explains how these insects may serve as carriers of the mosaic virus from one species of plant to another.

CONTROL

Insects

Control of mosaic in cucurbits is closely related to the control of the insects that spread the disease. The insects of greatest importance are the melon aphid and the striped and spotted cucumber beetles. The beetles are very effective carriers, because they are present thruout the season, and because they feed on many different plants. Aphids, when numerous, are capable of spreading the disease rapidly over an entire field. They are, however, not so generally present thruout the season and may be controlled by dusting or spraying with nicotine sulphate mixtures.

Spraying or dusting of cucurbits for the control of the mosaic disease is effective only to the extent that it prevents mosaic carrying insects from attacking the plants. (See beetle control on pages 15 and 16.)

Roguing Infected Plants

"Roguing" or pulling out of plants affected with the mosaic disease should prove of value, especially if only a few infected plants are present in the field. The practical difficulty with mosaic control thru

roguing is that when insects are present, many may have become contaminated before the infected plants are pulled out. Another difficulty in pulling infected plants is that plants may be infected with the mosaic disease and show no mottling even after considerable periods following infection. Cucumber plants have been observed where no mottling of the leaves could be noticed and where the only evidence of mosaic infection was the production of cucumbers showing mosaic symptoms.

Avoiding Infection from Wild Hosts

Cucumbers and cantaloupes should not be grown in the same field for two successive years. While mosaic is not carried over winter in the soil, susceptible perennial plants may become infected and serve as sources for infecting the following crops of cucurbits. In cucumber fields near Des Moines, in 1923, where cucumbers had been grown for three successive years, seven species of weeds were found affected with mosaic in addition to severe infection on the cucumbers. These weeds included three species of wild ground cherry, velvet leaf, spotted spurge and sweet clover. Weeds such as ground cherries, milkweed and pokeweed, which are susceptible to mosaic and which live over winter, should be eradicated as these may carry the mosaic disease for several years.

FUSARIUM WILT OF WATERMELONS

The Fusarium wilt disease is very widespread, occurring in the watermelon growing sections of the east, south and middle western parts of the United States. In Iowa many fields that are well adapted to growing watermelons have become infected with the wilt organism and can no longer profitably produce this crop. Fusarium wilt has been found in practically all areas in Iowa where watermelons are

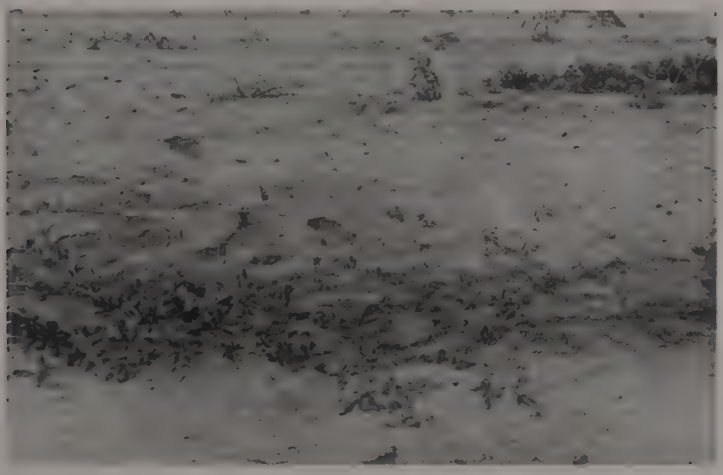

Fig. 6. Fusarium wilt of watermelon.

grown on a commercial basis, but the growers in the eastern part of the state have probably suffered most extensively.

SIGNS OF THE DISEASE

Watermelon plants affected with Fusarium wilt lose their normal turgid state and wilt. This wilting is first noticeable at the tips of the affected vines, and extends back until the whole vine is affected. (Fig. 6.) Plants apparently normal may wilt within a day, after which they dry up very soon.

A cross section near the base of a plant killed by Fusarium wilt shows browning of the woody portion of the stem. With the aid of a miscroscope the fungus threads can be seen in this area. Sometimes only one side of a stem is diseased. In other cases, certain runners of a plant may be infected while the others remain healthy.

CAUSAL AGENT

The cause of Fusarium wilt of watermelons is a fungus or mold which attacks the plants thru the roots or thru wounds on the stems above ground. After the fungus gains entrance it spreads thru the water conducting system. Decaying watermelon vines, killed by the Fusarium fungus, contain living organisms which produce many spores over a long period after the plant dies. These spores spread the disease and may remain alive for years, especially when kept dry on watermelon seed. The fungus not only remains alive thru the spores produced, but also by living on decaying organic material other than dead watermelon plants. Cantaloupes and cucumbers are not subject to Fusarium wilt.

Overwintering and Dissemination

A field infected with Fusarium wilt remains infected for years, even tho no watermelons are grown in the meantime. The wilt fungus may live from year to year in its spore stage, it may live on decaying watermelon vines, or on decaying organic matter.

Spread of Fusarium wilt of watermelons may result from the use of infected seed. The disease may be carried long distances on the seed and new fields may become inoculated.

The disease may be spread by any agency which carries soil or infected watermelon refuse from infected to non-infected fields. This method of spreading the disease is important mainly in the transfer of the wilt organism from one field to another on the same farm or to adjoining farms. Infected soil may be carried to non-infected fields by farm implements, on the feet of stock, manure containing infected watermelon refuse, and by draining water.

CONTROL

The control of Fusarium wilt of watermelons is largely a problem of prevention. Once a field is infected, little can be done to eradicate the fungus and years must elapse before watermelons can again be profitably grown. Fields that are infected with watermelon wilt should be used for other crops until the fungus has died out. Watermelon refuse should never be thrown on the manure pile or on compost heaps as the wilt organism grows well in decaying organic matter. A preventative measure is to treat the seed. (See seed treatment on page 14.)

Altho the watermelon varieties commonly grown are not resistant to Fusarium wilt, a variety known as Conqueror, which was developed by the United States Department of Agriculture, is quite resistant to the disease. This melon is the result of a cross between the citron and the variety of watermelon known as Eden. Conqueror is a large striped, oval, rather late melon. Its texture and flavor varies. Frank Everett of Oskaloosa has grown Conqueror for three years and advises that it has merit and deserves consideration where a grower has Fusarium sick soil and wishes to grow melons, but cannot change his ground.

ANGULAR LEAF SPOT OF CUCUMBER

Angular leaf spot, a bacterial disease that attacks leaves, stems and fruits of cucumbers, is widely distributed in the United States and, under favorable weather conditions, often causes considerable damage. Angular leaf spot is present in Iowa and growers of cucumbers should practice methods which will keep this disease from becoming a menace. Cantaloupes and watermelons are not attacked by the Angular leaf spot bacteria.

SIGNS OF THE DISEASE

On the leaves. Angular leaf spot infections are produced first on the leaves and they first appear as dark green, water-soaked areas. On newly infected areas, tear-like drops of material, an exudate, may be seen if the plants are examined early in the morning. A few days after infection the spots are white in appearance and become dry and brown. These areas are angular and irregular in shape and vary in size from about one-eighth to one-fourth inch across. The tissues in the spots become brittle and drop out, leaving ragged holes in the leaves.

On the fruit. Fruit infections first appear as small, dark, water-soaked areas. An exudate appears on these and in a short while following infection, the spots become white. Both these symptoms are similar to those present in the leaf infections. A gummy, amber colored material is sometimes found in connection with the spots on infected fruits. Fruit infections of angular leaf spot are about one-sixteenth inch in diameter, never becoming much larger.

Angular leaf spot causes a loss of leaf surface. A loss in fruit results that is more or less proportional to the seriousness of the infection. Cucumber fruits affected with this disease are spotted and often rots develop in these spots due to invasions of various other organisms.

CAUSAL AGENT

The bacterium producing angular leaf spot of cucumbers enters the plant thru the pores of the leaves. After infection has taken place, the bacteria multiply very rapidly.

The disease spreads from plant to plant in the field thru transference of the bacteria by splashing rains, wind, drainage water, or insects. The angular leaf spot bacteria overwinter principally on the seed, but may overwinter in the soil. Infected seed carry the disease to uninfected fields.

CONTROL

The control of angular leaf spot requires crop rotation and seed disinfection with mercuric chloride. (See page 14.) At present this disease is not common in Iowa and growers can, by treating all cucumber seed, prevent it from becoming established.

Spraying with 4-4-50 bordeaux mixture has been found to keep angular leaf spot from becoming serious in fields where it is present.

SEED TREATMENT

The most destructive diseases of cucumbers and melons that are transmitted on the seed are:

1. Anthracnose of cantaloupes, watermelons, and cucumbers.
2. Augular leaf spot of cucumbers.
3. Fusarium wilt of watermelons.

Seed treatment prevents these diseases being carried to the field on the seed and should be practiced by all growers of cucumbers, cantaloupes and watermelons. Treat the seed with a water solution of corrosive sublimate, also called mercuric chloride. Corrosive sublimate can be purchased at any drug store, either as a powder or in one gram or one-half gram tablets. Cucumber and melon seed should be treated by the following method:

(1) Dissolve corrosive sublimate in water at the rate of 1 gram for each quart.
(2) Place the seed in a thin cloth bag.
(3) Soak seed 10 minutes.
(4) Wash in clean water and spread out to dry. Sack in a new bag or in a bag that was dipped in the corrosive sublimate solution.

The tablet form of corrosive sublimate usually dissolves easier than the powder and is more convenient to use. Avoid making up this solution in metal containers; use woodenware, glassware, or earthenware containers. A gallon of the solution is sufficient to treat two quarts of seed, after which a new solution should be made up. Corrosive sublimate is a deadly poison when taken internally. Do not leave tablets or solution where they can be reached by children or by farm animals.

SPRAYING AND DUSTING

The application of sprays and dusts on growing melon and cantaloupe plants is recommended where these crops are attacked by anthracnose. This disease may be held in check by the application of bordeaux spray or Sander's bordeaux dust. Applications should be made sufficiently frequent to keep a protective covering on the plants from the time the disease appears until harvest.

Bordeaux Mixture

Bordeaux mixture consists of copper sulphate, lump lime and water, in the following proportions:

Copper sulphate (or blue vitriol)	4 pounds
Burned (unslaked) lime	4 pounds
Water	50 gallons

The most feasible way to prepare the solution is to dissolve four pounds of copper sulphate in 45 gallons of water, and slake four pounds of burned lime in five gallons of water and pour the strong lime into the weak copper sulphate solution. Stir vigorously while pouring the two solutions together as vigorous agitation insures a finer mixture. The finer the mixture the better it sticks and spreads over the foliage. When it is necessary to combat both anthracnose and beetles, two pounds of either calcium arsenate or lead arsenate may be added to 50 gallons of bordeaux mixture.

Sander's Bordeaux Dust

Sander's bordeaux dust is made by mixing hydrated lime and monohydrate copper sulphate (also dehydrated copper sulphate) in the following proportions:

Hydrated lime ----------85 pounds
Monohydrate copper sulphate----------15 pounds

These materials may be mixed in a tub with a paddle or in the mixer described below. Where both anthracnose and beetles are combatted, five pounds of calcium arsenate should be mixed with 100 pounds of the Sander's bordeaux dust.

Homemade Dust Mixers

A convenient apparatus for the preparation of dust is an old barrel churn. To help mix the dusts it is well to add a gallon of pebbles about the size of hen's eggs. Barrels for mixing may also be improvised by attaching a shaft to each end of a closed barrel and suspending on a frame so the barrel can be turned with a crank. (See Fig. 7.) A hole is cut in the side, the piece taken out being used as a door. The materials are mixed by turning the barrel for about five minutes. In preparing nicodust, the Black Leaf 40 must be added after the lime.

Calcium Arsenate

For the control of mosaic and bacterial wilt in cucumbers and cantaloupe, the plants require protection from beetle infestation until the melons and cucumbers ripen. To control the cucumber beetles, the plants should be dusted with calcium arsenate, mixed with either hydrated lime or gypsum. This dust is made as follows:

Calcium arsenate ---------- 1 lbs.
Hydrated lime or gypsum----------10 lbs.

These materials should be thoroly mixed, which may be done by the dust mixer described above or by stirring them together in a tub or box.

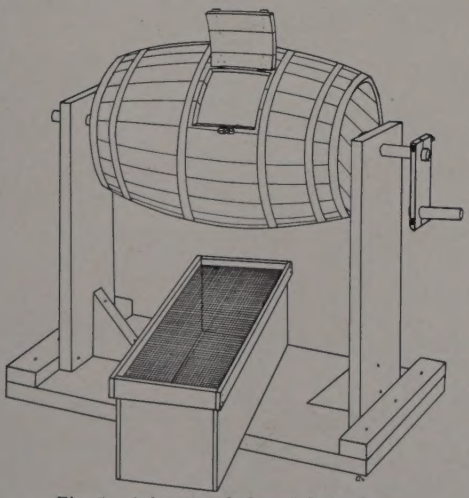

Fig. 7. A home-made barrel dust mixer.

Calcium arsenate and gypsum should be used liberally to protect the plants from the time they come up until they begin to run. Considerable dust is required on the plants all the time. This dust may be applied either with a pail, the bottom of which is perforated with nail holes, or it may be sprinkled on with hands. Gypsum is used because when applied liberally it does not produce burning as does lime.

After the plants begin running, hydrated

lime may be substituted for gypsum. This dust should be applied with a hand duster. The lime being lighter and finer than gypsum is more satisfactory for use in dusters. No burning has been observed when the lime was applied with a duster. Applications should be made at weekly intervals or often enough to keep a light covering of the dust on the plants.

Nicodust

For the control of aphids, or plant lice, which spread mosaic disease, cucumber and melon plants should be dusted with nicodust. Nicodust under different trade names may be purchased on the market, or growers can easily prepare their own dust at a great saving. Nicodust of a two percent concentration of nicotine is made as follows:

Black leaf 40 ---------- 5 lbs.
Hydrated Lime ---------- 100 lbs.

Black Leaf 40 may be purchased at drug stores. It is a liquid and care must be taken in preparation of nicodust that the ingredients are thoroly mixed. After nicodust is prepared it should either be applied immediately or stored in airtight containers. Homemade nicodust will cost less than 10 cents per pound, while the commercial product costs at least twice this amount.

Dusting Machines

Dusting cucurbits has certain advantages over applying of sprays. Chief among these advantages is the comparative ease and rapidity with which a field can be dusted. The chief difficulty with dusting is that dust is more easily washed off by rains than are wet sprays.

Initial cost for equipment and labor is less expensive for dusting than for spraying. Suitable hand dusters cost about $20, and one duster is sufficient for the average cucumber or melon grower. These dusters may also be used for controlling insects or diseases of other crops. While two men are necessary for applying a spray, only one is required for dusting. In selecting a duster, a number of points should be taken into consideration. A continuous stream type of duster is more suitable for dusting cucumbers and melons than the puff type. A duster should be well made mechanically and easy to manipulate. A large capacity magazine is an advantage and the duster should be equipped with a feed regulator. For best results, a duster must have sufficient force at a moderate speed of the crank to deliver a cloud of finely divided dust. A duster with a rigid delivery tube, or one out of reach of the operator's hand, is much less convenient than a type where the delivery tube is flexible so the dust stream can be guided with the hand.